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Technical Note 6-79



GUIDELINES FOR TESTING VARIOUS WEAPONS/MUNITIONS AGAINST
MOBA STRUCTURES

Brenda K. Thein
Glenn P. Beichler
Stephen J. Zardas
William H. Jack

October 1979
AMCMS Code 612716.H700011

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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER Technical Note 6-79	2. GOVT ACCESSION NO.	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) GUIDELINES FOR TESTING VARIOUS WEAPONS/ MUNITIONS AGAINST MOBA STRUCTURES		5. TYPE OF REPORT & PERIOD COVERED Final
7. AUTHOR(s) Brenda K. Thein William H. Jack Glenn P. Beichler Stephen J. Zardas		6. PERFORMING ORG. REPORT NUMBER
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Human Engineering Laboratory Aberdeen Proving Ground, MD 21005		8. CONTRACT OR GRANT NUMBER(s)
11. CONTROLLING OFFICE NAME AND ADDRESS		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AMCMS Code 612716.H700011
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		12. REPORT DATE October 1979
		13. NUMBER OF PAGES 45
		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE
16. DISTRIBUTION STATEMENT (of this Report) <div style="display: flex; justify-content: space-between;"> <div> Distribution limit evaluation, October referred to Director Aberdeen Proving Ground </div> <div> Approved for public release; Distribution is unlimited </div> <div> only test and document must be laboratory </div> </div>		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) Military Operations in Built-up Areas (MOBA) Military Operations On Urbanized Terrain (MOUT) Testing Combat-in-Cities Weapons Effect Urban Warfare Data Collection Assault Weapons		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) Uniformity in testing and data collection simplifies the problem of comparing systems. The purpose of this report, which is based on previous test experience, is to provide <u>general</u> guidelines for testing and collecting data for weapon effects evaluations for military operations on urbanized terrain (MOUT).		

GUIDELINES FOR TESTING VARIOUS WEAPONS/MUNITIONS AGAINST
MOBA STRUCTURES

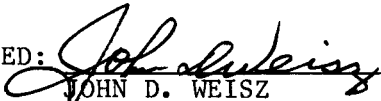
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FOREWORD

The purpose of this report is to provide examples to be used as general guidelines for weapons effectiveness testing for Military Operations in Built-up Areas (MOBA). It is based primarily on experience gained during the conduct of the following tests:

1. 105mm tank rounds fired against 8-, 10-, and 16-inch reinforced concrete walls and brick/block walls.

2. Small arms rounds ranging from 5.56mm to .50 cal fired against 8-, 10-, and 16-inch reinforced concrete, 12-inch solid brick and brick/block walls.

3. Test firing of the SMAW, an experimental munition, against 8-, 10-, and 16-inch reinforced concrete, 12-inch solid brick and brick/block walls.

4. Test firing of the SHAWL, an experimental munition, against 8-inch reinforced concrete, 12-inch solid brick and brick/block walls.

5. Test firing of the LAW, DRAGON and TOW against 10-inch reinforced concrete walls.

CONTENTS

BACKGROUND	3
TEST OBJECTIVES	3
APPROACH	4
FIRING PROCEDURE	5
DATA COLLECTION	13
AREAS OF RESPONSIBILITY	14

APPENDIXES

A. Data Collection Forms	17
B. Standard Operating Procedure	25
C. List of Material and Equipment	39

FIGURES

1. Typical Firing Configuration, Without Camera Locations	7
2. Typical Firing Configuration, With Camera Locations	8
3. Typical Instrumented Room for In-Wall/On-Wall Bursts	9
4. Typical Instrumented Room for In-Room Bursts	10
5. Firing Lines, Transfer Box	11
6. Firing Line, Locked Box	12

TABLES

1. Pertinent Munition Characteristics for Structure Tests	5
2. Projectile Type, Number of Firings, and Angle of Fire Against MOBA-Type Targets	6

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GUIDELINES FOR TESTING VARIOUS WEAPONS/MUNITIONS AGAINST MOBA STRUCTURES

BACKGROUND

It is often difficult to make reliable predictions of the terminal effectiveness of various types of weapons/munitions when fired against masonry structures such as those that would typically be encountered in MOBA (Military Operations in Built-Up Areas). While it may not be necessary to test every weapon/munition of a given type, it will probably be necessary to test each type of weapon/munition, e.g., HEAT, HEP and KE; rounds with various fuze times (artillery super-quick, VT, delay, etc.); or each unique concept, e.g., follow-through warheads, rounds with void-sensing fuzes, or rounds utilizing more than one detonation point. Several weapon/munition types have already been tested, and a data base has been initiated.

A meeting was held at the US Army Human Engineering Laboratory (HEL), on 4-5 April 1979, and was attended by representatives of HEL, US Army Test and Evaluation Command (TECOM), US Army Materiel Systems Analysis Activity (AMSAA), US Army Ballistic Research Laboratory (BRL), US Army Infantry School (USAIS), US Army Training and Doctrine Command Headquarters (TRADOC HQ), and the US Marine Corps many of whom have been involved in the testing of weapons effects in MOBA. At the meeting, it was decided that guidelines should be issued to insure that some reasonably uniform testing and data collection methods are used, which will be similar to those used in previous tests. (Uniformity in testing and data collection make it possible for the analyst to make comparisons among the various weapons/munitions tested.) The purpose of this report, therefore, is to provide some general guidelines for testing and data collection of weapons effects data for MOBA.

Although this report emphasizes testing against walls, these same guidelines also apply for testing against bunkers.

TEST OBJECTIVES

The objectives of the test should be:

- to determine the ability of various weapons/munitions to penetrate/perforate various structures.

- to determine the ability of various weapons/munitions to incapacitate the personnel located in the structures through such mechanisms as projectile and wall fragments, shaped-charge jets, etc.

- to determine the ability of various weapons/munitions to provide access holes for troop mobility.

- to determine safety hazards to gunners/troops from various weapons/munitions fired at the structures.

- to supply quantitative data on the ability of various weapons/munitions to provide obscuration/suppression effects.

- to determine the effects on structure from projectile impacts.

APPROACH

The objectives of the test should be accomplished by conducting limited full scale firings of the munitions against the structures. During the test the following items should be varied:

- Target type and thickness (for walls).

- Projectile impact angle.

- Projectile impact location.

The structure selected for testing should adequately represent the type of construction which is likely to be encountered under actual urban conditions.^{1,2,3} Furthermore, those firings in which minimum damage is expected should be conducted first in order to keep the total number of structures required to a minimum. In addition, in order to obtain the desired data, witness screens and extensive photographic coverage should be used.

¹Ellefsen, R., Coffland, B., & Orr, G. Urban building characteristics: Setting and structure of building types in selected world cities. Naval Surface Weapons Center Report NSWC/DLTR-3714, San Jose State University, San Jose, CA, 15 January 1977.

²Belakon, A.P. Engineer organization of a rifle company defense area. FSTC Technical Translation, FSTC-HT-23-1024-70, Ministry of Defense, Moscow.

³Thein, B.K., & Coltharp, D.R. Interim standards for the construction of MOBA structures for weapons effects tests. Technical Memorandum 30-78, US Army Human Engineering Laboratory, Aberdeen Proving Ground, MD, Dec 1978.

The test plan should include pertinent characteristics of the various munitions to be fired at the target structure. (See Table 1 for sample.)

TABLE 1
Pertinent Munition Characteristics for Structure Tests
(Sample)

Round Designation	Round Type	Explosive Type	Explosive Wt. (Kg)	Muzzle Velocity (mps)	Test Range (Meters)
DRAGON	HEAT	OCTOL	1.59	76.2	80
M 393	HEP	A-3	3.00	731.0	60
M 392	KE	-	-	1478.0	60
M 456	HEAT	Comp B	.97	-	60
SHAWL	HEAT/HE	LX14/PBX9205	.54/.23	198.2	15
TOW	HEAT	OCTOL	2.36	79/310	80/300

The test plan should also include the location of the test site and the scheduled starting data of the test, as well as the approximate time it will take to complete the test (this should include the setup time, testing, and closing down time).

Additionally, it should include the projected total number of firings, accompanied by a table giving the number of firings, angle of fire, target, and type of firing; i.e., dynamic or static for each munition type (see Table 2 for sample) to be tested.

FIRING PROCEDURE

The various weapons should be remotely fired for safety and to facilitate the proper sequencing of the movie cameras and instrumentation. Figure 1 shows a typical firing configuration with instrumentation lines, firing line, firing trajectory, and weapon location. Figure 2 shows the data cameras and necessary lines. Figure 3 shows a typical target room with panels in place for rounds bursting on the wall, and Figure 4 shows the target room with panels in place for rounds bursting in the room. Figures 5 and 6 show examples of wiring and method of operation for safety control boxes.

TABLE 2

Projectile Type, Number of Firings, and Angle of Fire Against
MOBA-Type Targets (Sample)

Round Designation	Angle of Fire (Degrees)	WALL TYPES				Bunker Earth/ Timber	Type of Firing
		Reinforced 16 in.	Concrete 8 in.	Solid Brick 20 in.	Brick/Block 12 in.		
DRAGON	0	3	3	3	3	3	Dynamic
	30	3	3	3	3	3	Dynamic
M 393	0	3	3	3	3	3	Dynamic
	30	3	3	3	3	3	Dynamic
M 456	0	2	2	2	2	-	Static
	0	2	2	2	2	2	Dynamic
	30	2	2	2	2	2	Dynamic
M 392	0	3	3	3	3	3	Dynamic
	30	3	3	3	3	3	Dynamic
SHAWL	0	-	3	-	3	3	Dynamic
	30	-	3	-	3	3	Dynamic
TOW	0	2	2	2	2	2	Dynamic
	30	2	2	2	2	2	Dynamic
	0	2	2	2	2	2	Dynamic
	30	2	2	2	2	2	Dynamic

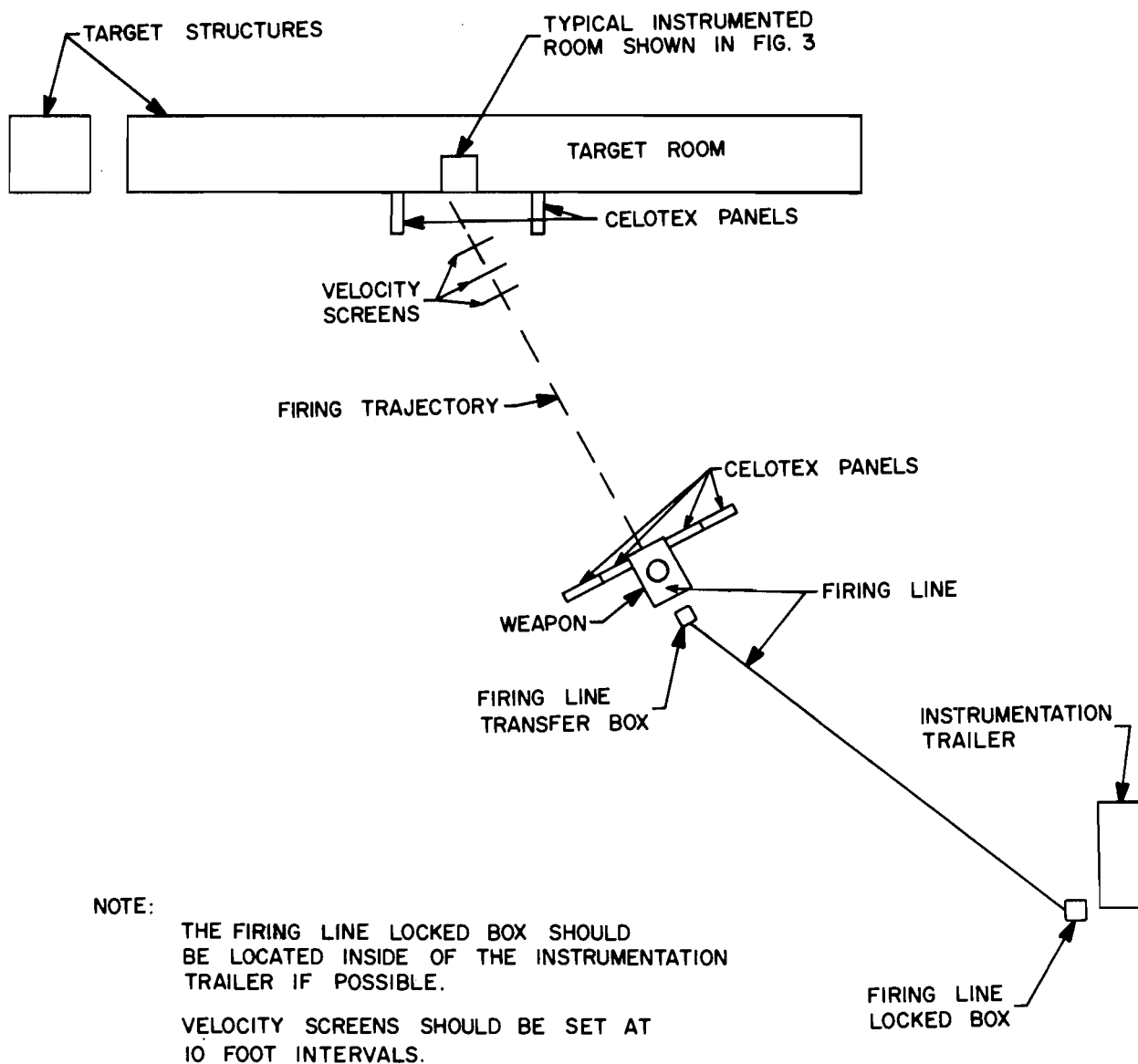
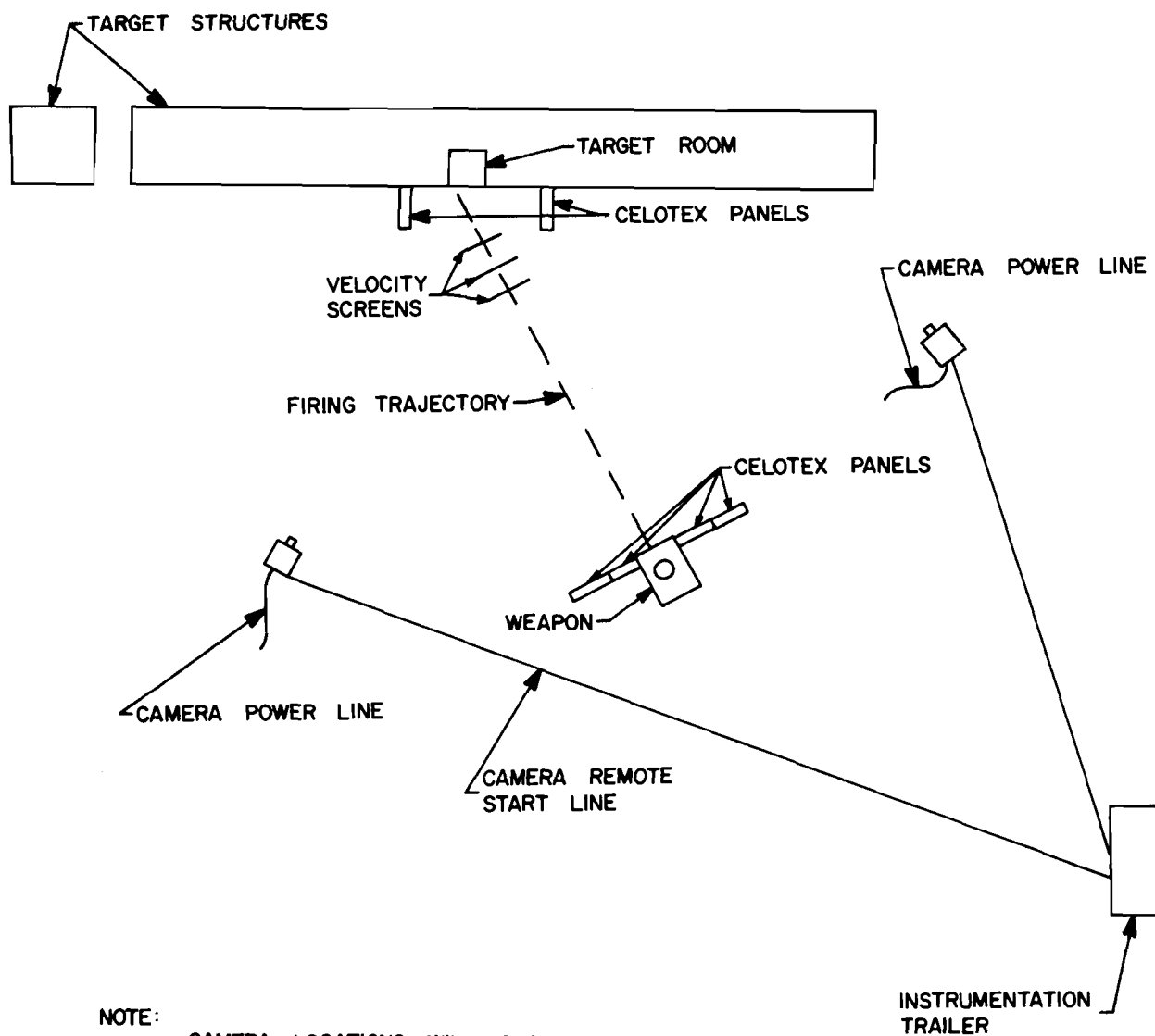


Figure 1. Typical firing configuration, without camera locations.



NOTE:

CAMERA LOCATIONS WILL CHANGE WITH
DATA REQUIREMENTS AND TARGET ROOMS

CAMERA REMOTE LINES SHOULD HAVE
APPROXIMATELY 1/2 SECOND DELAY
BEFORE FIRING EVENT.

CAMERA POWER SUPPLY GENERATOR SHOULD
BE LOCATED CONVENIENTLY TO EXPECTED
CAMERA LOCATIONS.

Figure 2. Typical firing configuration, with camera locations.

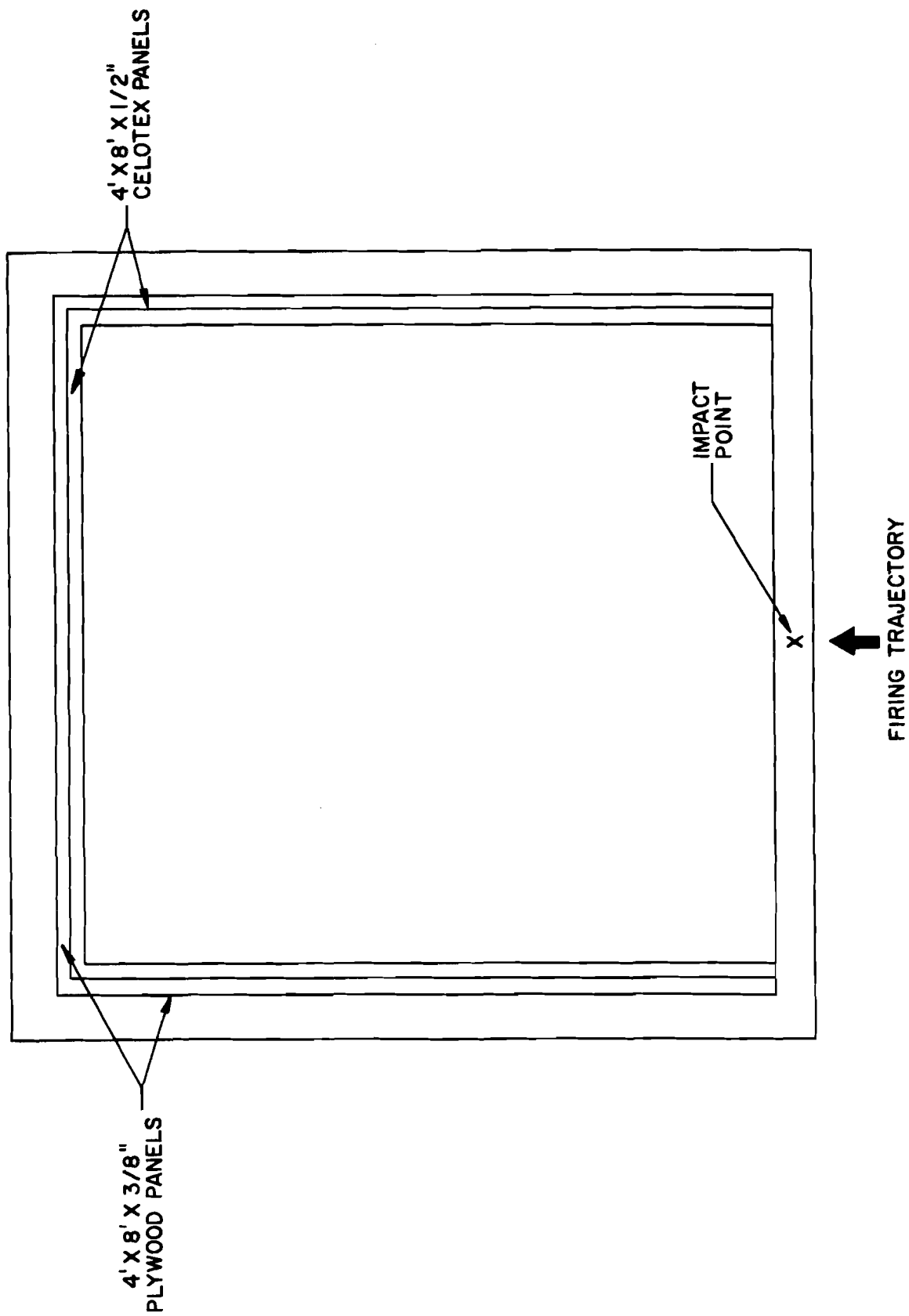


Figure 3. Typical instrumented room for in-wall/on-wall bursts.

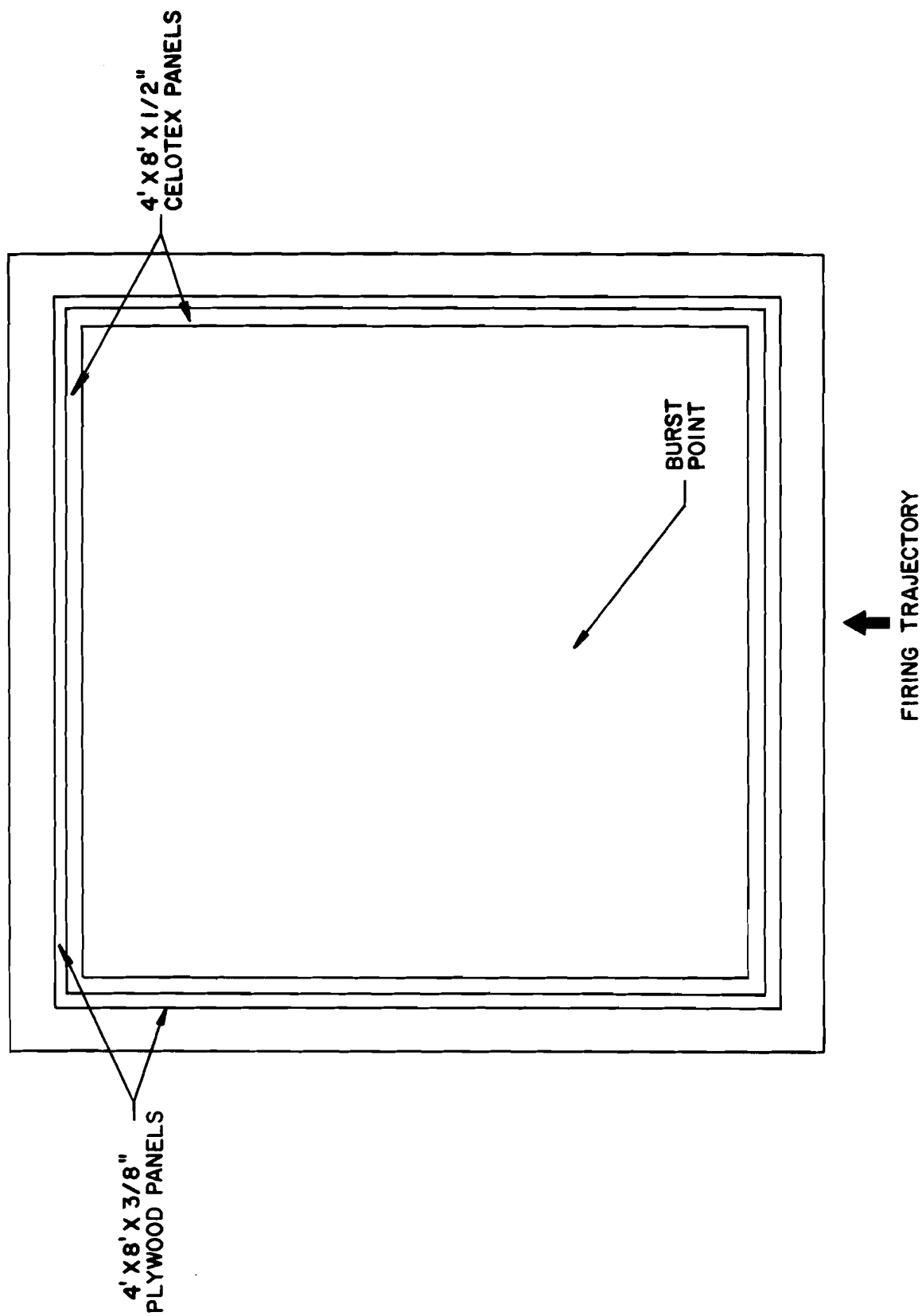


Figure 4. Typical instrumented room for in-room bursts.

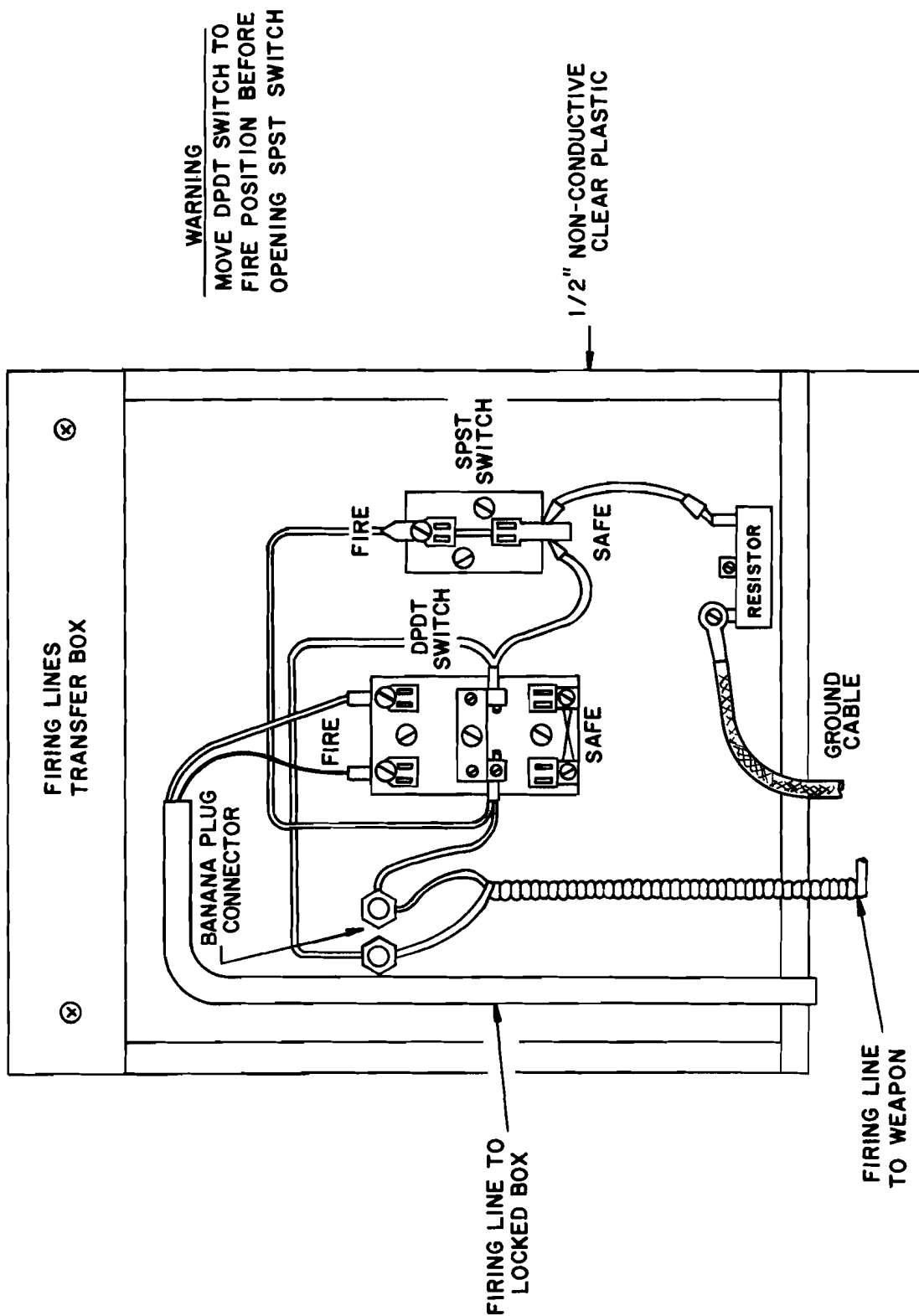


Figure 5. Firing lines, transfer box (sample).

LOCKED BOX

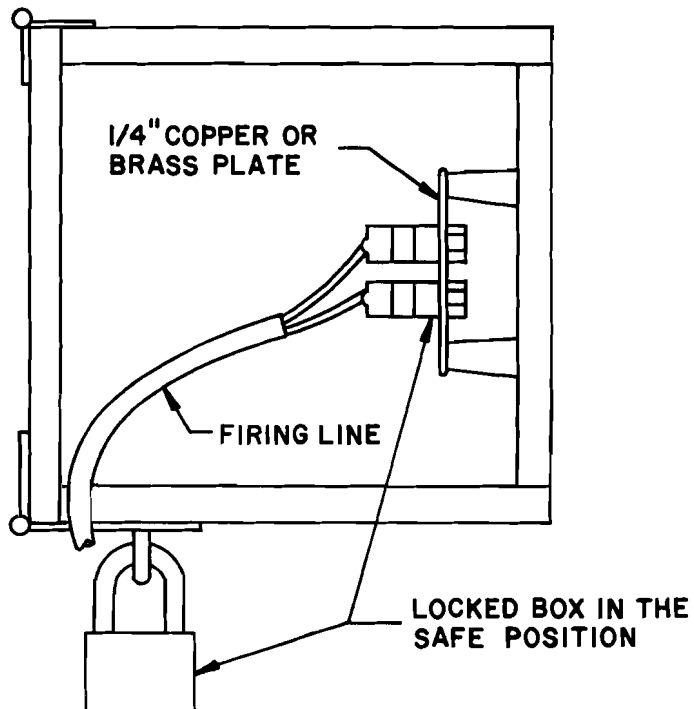
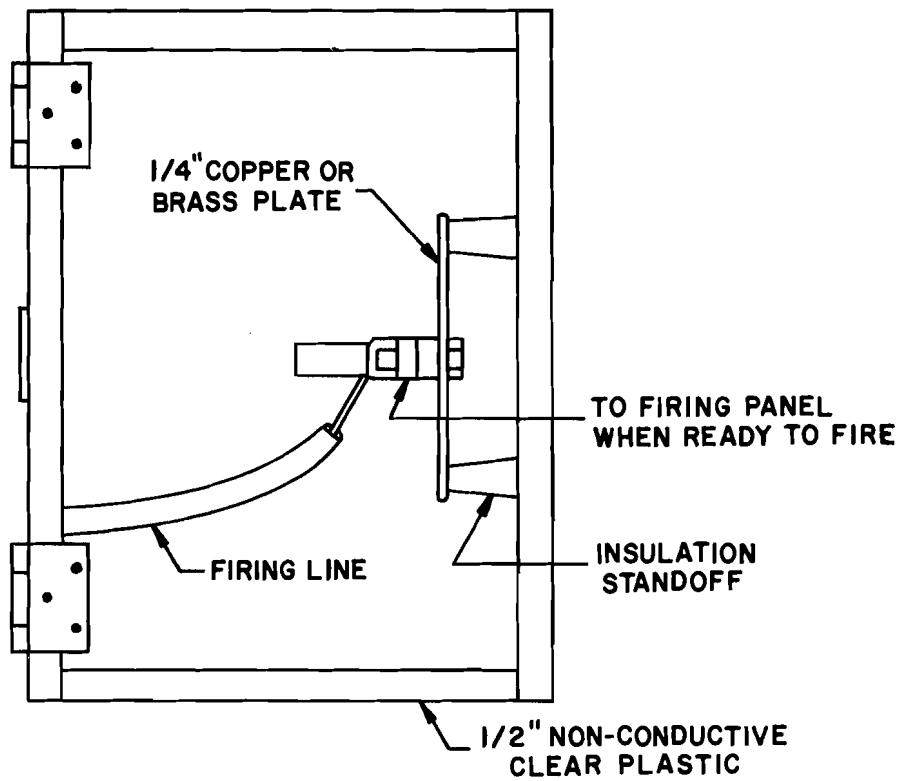


Figure 6. Firing line, locked box (sample).

DATA COLLECTION

The data collection should provide for the collection and recording of significant target effects during the conduct of the munitions test. When the firings are directed against masonry structures, significant target effects require the collection and recording of in-front-of and behind-wall data. Such data is divided into instrumented and noninstrumented categories.

a. Instrumented Data: Projectile impact velocities should be recorded with velocity screens (Figure 1). Projectile impacts should also be recorded photographically with high speed and real-time movies.

b. Noninstrumented Data: In-front-of and behind-wall fragment distribution should be collected using 3/8-inch plywood and 1/2-inch celotex witness panels.

Both instrumented and noninstrumented events should be documented with still color photographs, real-time, 16mm movies and high-speed 16mm movies.

Data collection forms should be used to record projectile strikes, fragment impacts, and gross observations (as a minimum) pertinent to smoke and dust in the room after the shot.

Noninstrumented data pertinent to structural damage and behind-wall and in-front-of wall fragment distributions that are collected should consist of the following:

- Inside room dimensions after the data panels are installed.
- Dimensions of each of the data collector panels (these panels should be numbered starting on the left hand side of the room and continuing around the room. Additionally, the panels should be gridded in 12-inch squares for ease of data collection).
- Projectile impact location.
- Maximum and minimum spall diameters for both the outside and inside of the impact wall.
- Maximum and minimum through-hole diameters for both the outside and the inside of the impact wall.
- Impact wall thickness and type.
- All perforations of only the 1/2-inch Celotex panels.
- All perforations of both the 1/2-inch Celotex and 3/8-inch plywood panels.

- The location of each of the holes in the collector panels (see data collection sheets).

- The time of firing.

- The time for smoke and dust to clear the room.

AREAS OF RESPONSIBILITY

Test Agency

1. Provide a test director to be responsible for all the technical direction of the test, and to assure a smooth flow of operations.

2. Provide personnel for the data collection; i.e., fragment data, structural damage data, movies and still photography, etc.

3. Provide personnel for general support; e.g., paneling inside of target rooms for fragment data collection.

4. Provide Standard Operating Procedure for firing of the weapons (subject to approval by the test site safety officer).

5. Provide for range and safety control in coordination with site manager.

6. Provide for on-site EOD capability.

7. Provide a person(s) thoroughly familiar with the weapon system(s) being tested.

8. Provide for materials used in conduct of test.

9. Provide for ammunition/weapons to be tested.

Test Site

1. Furnish area containing target structures.

2. Provide a secure and safe storage area, reasonably close to the firing site, for all test ammunition and equipment.

3. Provide a vehicle for transporting ammunition from storage to firing site.

4. Provide a power supply for remote firings (a 45-kw generator is acceptable).

5. Provide a suitable medium (e.g., a surplus trailer) for use as an instrumentation/control van.

6. Provide a land line telephone for contact with outside agencies.

7. Provide cover/revetment for protection of personnel and nontest equipment.

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APPENDIX A

DATA COLLECTION FORMS

FIRING DATA SHEET

<u>DATE</u>	_____	<u>TIME</u>	_____
<u>SHOT NO.</u>	_____		_____
<u>PROJECTILE TYPE</u>	_____		_____
<u>ROOM NO.</u>	_____		_____
<u>WALL TYPE</u>	_____		_____
<u>WALL THICKNESS</u>	_____		_____
<u>AIM POINT</u>	_____		_____
<u>IMPACT ANGLE</u>	_____		_____
<u>DISTANCE - LAUNCHER TO IMPACT POINT</u>	_____		_____
<u>TIME OF FIRING</u>	_____		_____
<u>TIME DUST CLEARS (IN ROOM)</u>	_____		_____

Figure 1A. Firing data form.

ROOM
DIMENSIONS:

WIDTH: FRONT _____

WIDTH: REAR _____

LENGTH:

RIGHT SIDE _____

LEFT SIDE _____

PANEL I →

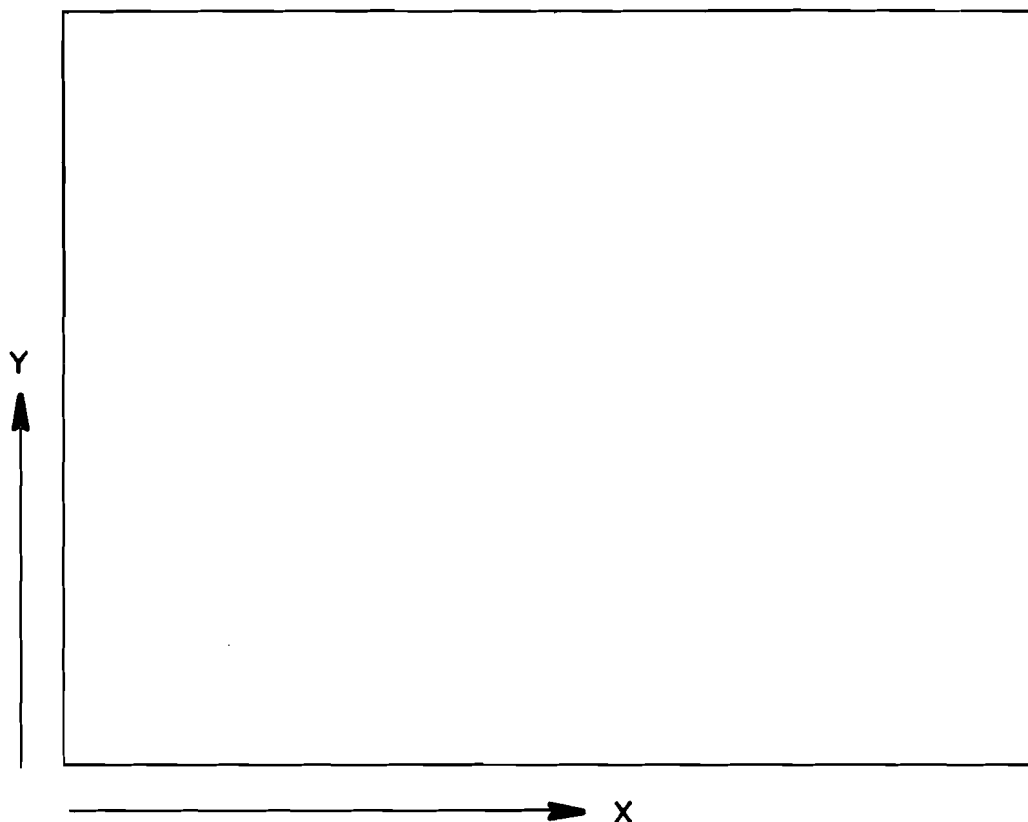
PANELED ROOM
(OVERHEAD VIEW)

	*H	**W		H	W
PANEL NO_____	PANEL DIM_____	X_____	PANEL NO_____	PANEL DIM_____	X_____
PANEL NO_____	PANEL DIM_____	X_____	PANEL NO_____	PANEL DIM_____	X_____
PANEL NO_____	PANEL DIM_____	X_____	PANEL NO_____	PANEL DIM_____	X_____
PANEL NO_____	PANEL DIM_____	X_____	PANEL NO_____	PANEL DIM_____	X_____
PANEL NO_____	PANEL DIM_____	X_____	PANEL NO_____	PANEL DIM_____	X_____
PANEL NO_____	PANEL DIM_____	X_____	PANEL NO_____	PANEL DIM_____	X_____
PANEL NO_____	PANEL DIM_____	X_____	PANEL NO_____	PANEL DIM_____	X_____
PANEL NO_____	PANEL DIM_____	X_____	PANEL NO_____	PANEL DIM_____	X_____
PANEL NO_____	PANEL DIM_____	X_____	PANEL NO_____	PANEL DIM_____	X_____

*H=HEIGHT; **W=WIDTH

Figure 2A. Panel location and dimension data.

SHOT NO _____ PROJECTILE TYPE _____ WALL TYPE _____



IMPACT COORDINATES			ENTRANCE SPALL	ENTRANCE HOLE	EXIT HOLE	EXIT SPALL
<u>X</u>	<u>Y</u>	MAX DIA				
		MIN DIA				
		DEPTH				

Figure 3A. Impact location and structural data.

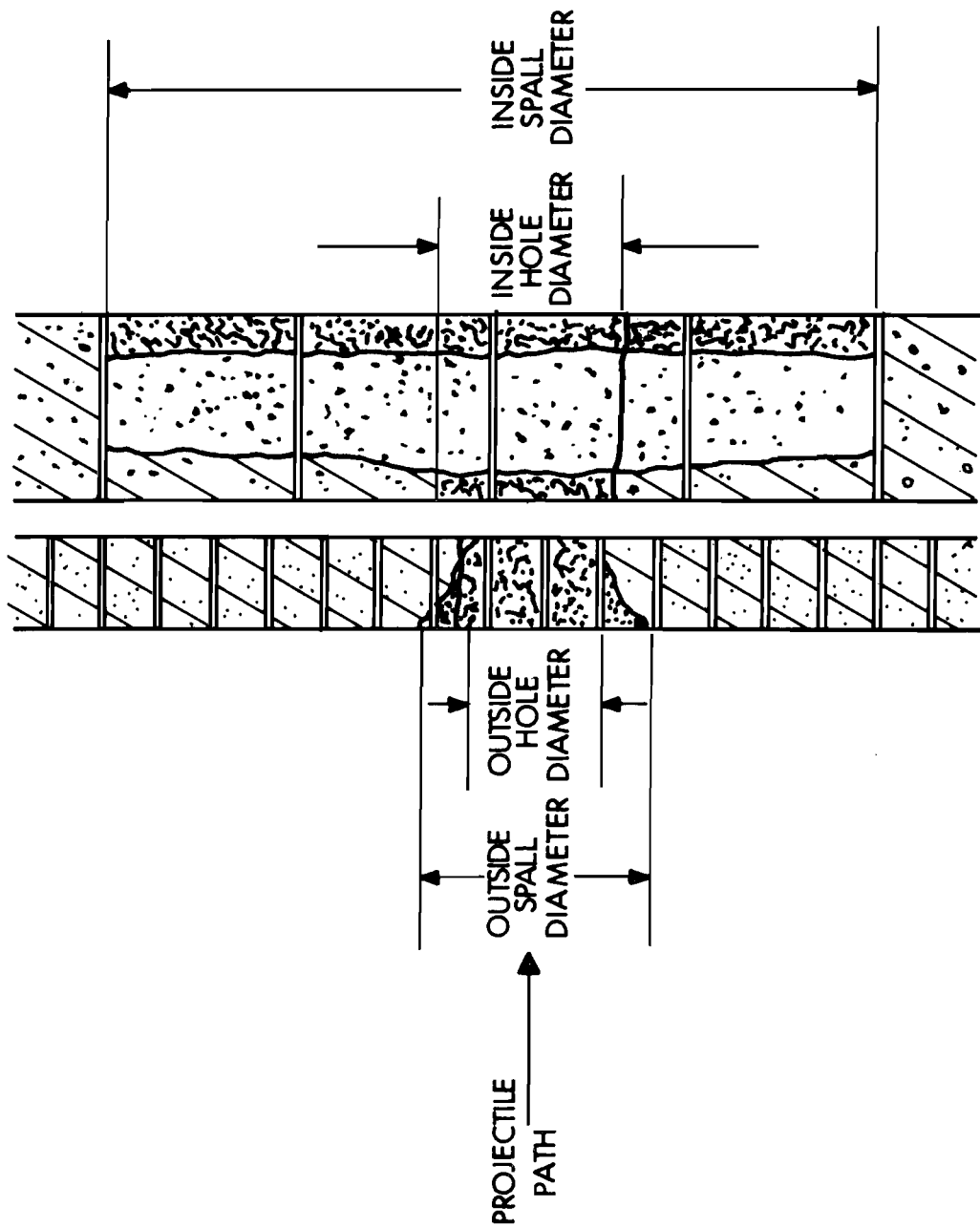


Figure 3A(1). Brick/block wall.

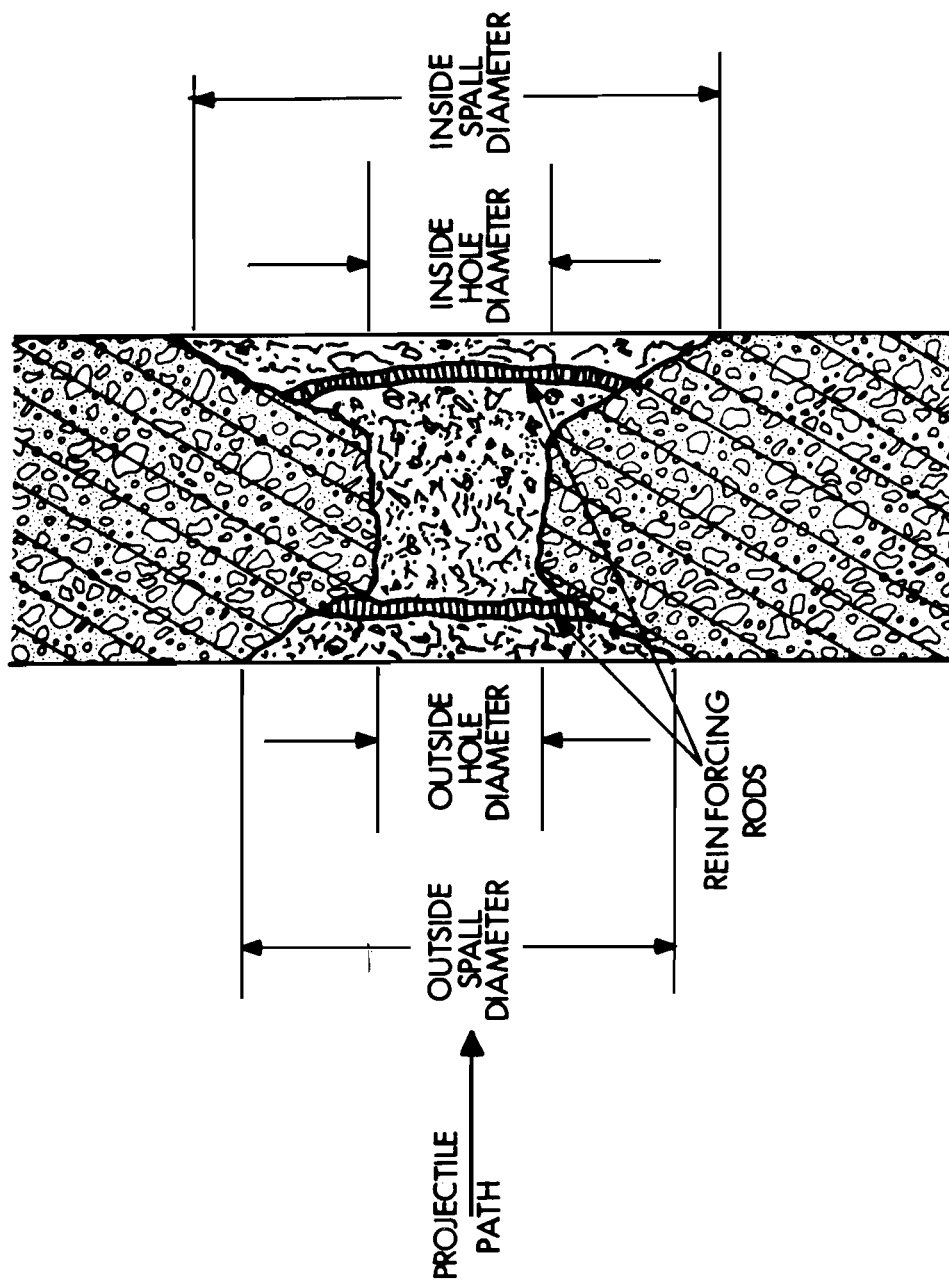


Figure 3A(2). Reinforced concrete wall and solid brick wall (without reinforcing).

SCALE: 1 BLOCK = 1 INCH





PROJECTILE _____

SHOT NO _____





ROOM NO _____

PANEL NO _____

CELOTEX

	HOLE
	NUMEROUS HITS
	DESTROYED
	CRACKED

PLYWOOD

	HOLE
	SPLINTERED
	DESTROYED
	CRACKED

COMMENTS

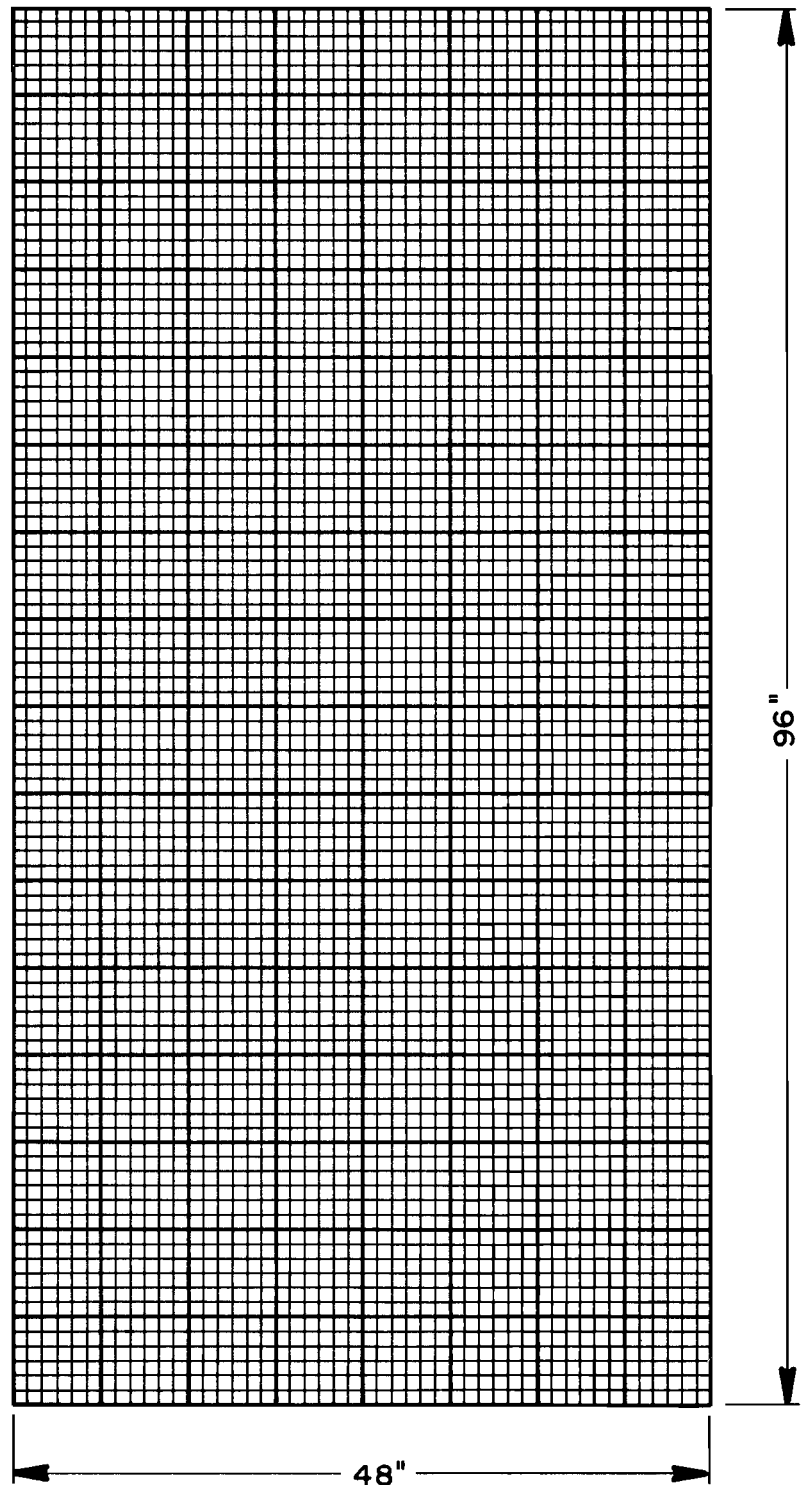


Figure 4A. Data collection form.

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APPENDIX B

STANDARD OPERATING PROCEDURE
(SAMPLE)

Standard Operating Procedure for Safety
(Sample)

1. ORGANIZATION: MOUT Weapons Test Group, XYZ Agency and PDQ Test Site, Anywhere, USA.

2. NAME OF OPERATION: Firing projectiles against structures.

3. PURPOSE: To establish safe operating procedures and assign responsibility in order to minimize hazards to personnel who are engaged in firing programs at the test site. Operations not adequately covered by the procedure shall be included in an approved supplement or a separate SOP dealing with the specialized and/or specific characteristics of the test program.

4. DEFINITIONS:

a. Project test director or officer will be construed to be one and the same person and will be referred to as test director. This person is the qualified individual who has full responsibility for the safety and conduct of the firing program or test.

b. Gunners/Operators: Personnel assigned to load/fire weapons will be qualified gunner/EOD.

c. Damage Assessment Personnel: Personnel who are familiar with test procedures and qualified to make damage assessment and to assist test director in conduct of test.

5. RESPONSIBILITY:

a. Each individual is responsible for personal compliance with the provisions of this SOP and any test site SOPs or pertinent directives and the range procedures to the extent and degree covered by his individual duty assignment.

b. Test director is responsible for:

(1) Ensuring that all personnel involved in the test are thoroughly familiar with the nature and type of materials handled, the hazards involved and the precautions for safe handling of such materials. He will ensure that personnel are not unnecessarily exposed to any hazard. He will ensure that the test is controlled in accordance with approved procedures.

(2) Taking necessary action to protect, by adequate cover or distance, all personnel and any facilities and equipment (not intended to be part of the test) from any blast or fragments, resulting from the firing program under his control.

(3) Placement of fragment/spall recovery materials, electronic instrumentation and high speed cameras, etc., prior to test firing.

(4) Assessment of structures for safety after firing and prior to permitting the damage assessment team to enter the target structure.

(5) Firing Weapon: In the event of a misfire or malfunction, he will immediately suspend firing tests until corrective action has been taken in accordance with established misfire procedures.

c. Test site manager or his representative is responsible: for coordinating scheduling and to make sure the necessary precautions are taken as firing and area clearance; i.e., road blocks, guards, etc.

d. Gun Crew OIC is fully responsible for: preparation, loading and firing of weapon.

6. PERSONNEL LIMITS: The number of operational personnel and transients permitted at the firing site or in the danger area will be held to the absolute minimum necessary for efficient operation of the test. All personnel will be placed under adequate cover or removed from the danger area at the time of firing. Personnel will not be unnecessarily exposed to any hazard.

7. ELECTRICAL STORMS: During an electrical storm in the immediate area, firing will cease and personnel evacuated to an appropriate shelter.

8. WEAPON PLACEMENT: The test director will supervise each weapon emplacement. He will inspect the test site to assure that the entire site meets explosive handling requirements; that the gun crew is properly trained, instructed and assigned to meet operational, range and industrial safety requirements; and that the weapon is properly emplaced and assembled in all respects.

9. In addition to all requirements contained herein, the test director will comply with applicable test site requirements as directed by the Site Manager's Representative.

10. REFERENCES:

a. AR 385-63

b. AMCR 385-100

c. MTD SOP 385-67

d. APG Regulation 385-1

11. Applicable safety fans are attached.

SEQUENCE OF OPERATIONS

The test director or team member assigned by the test director will:

- a. Select target (point and angle of impact).
- b. Mark target as aim point for camera reference and bore site picture.
- c. Position instrumentation as required.
- d. Locate and aim weapon (check azimuth for firing limits).
- e. Check firing lines. Short and secure firing line.
- f. All personnel not required to load the weapon will be placed under adequate cover or removed from the danger area. (Ensure road guard is in position.)
- g. The test director will obtain firing clearance from site manager's representative.
- h. After clearance is granted, remove round from storage and prepare as necessary for loading. (The gun crew member to load the weapon will have in his possession the firing key or removable safety link.)
- i. Check bore and load weapon in accordance with safe loading practices applicable to the particular weapon and round involved. (Ensure that no extraneous items or matter, powder, residue, etc., are present.)
- j. All personnel will retire to protective cover.
- k. After visual observation of the area to confirm the danger area is clear, sound warning device three (3) times to warn personnel that a round is to be fired.
- l. Insert safety link or unlock firing lines and "FIRE" as indicated by type of instrumentation used.
- m. Lock out firing lines or remove safety link and sound one (1) blast on warning device to indicate "ALL CLEAR". NOTE: Members of Damage Assessment Team will not enter target structures until area has been declared safe by Test Director.

SAFETY REQUIREMENTS

a. Industrial:

(1) Smoking or carrying of flame producing devices is prohibited within fifty (50) feet of any hazardous material. This restriction will be conspicuously posted.

(2) Mechanical materials handling equipment will be employed to handle heavy objects.

(3) All electrical equipment will be adequately grounded.

(4) Personal safety equipment will be worn as required. Hard hats and safety glasses will be worn by personnel in accomplishing damage assessment inside structures. Explosive operators cotton overalls will be worn by the gun crew and ammunition handlers.

(5) Safety shoes will be worn by gun crew personnel, damage assessment team members and operating personnel.

(6) Safety glasses or goggles will be worn during operations that may produce fragments, chips, etc.

(7) Gloves will be worn when personnel are performing operations involving material that is hot, abrasive, sharp, etc.

(8) Ear plugs or ear muffs will be worn by personnel exposed to excessive noise.

(9) All hand tools used in the presence of igniter, primer, loaded case, and/or other hazardous materials will be of non-sparking material.

(10) Area should be cleared of materials lying around the work area prior to beginning work to set up the next shot or operation (boards with nails, etc.).

b. Munitions:

(1) Not more than one day's supply of ammunition will be brought to the firing site at one time.

(2) Ammunition at the firing site will be kept in earth covered building near the firing site to minimize accidental ignition or explosion from malfunction of the weapon or from other outside sources.

(3) Ammunition at the firing site will be protected from solar radiation.

(4) Ammunition in containers will be placed at the firing site on their sides, on tables, racks, or on the ground; ammunition removed from the containers may be similarly positioned except that ammunition on the ground will be placed in dunnage.

(5) Complete rounds not in packing that protects the primer, will be fitted with primer protectors.

(6) The test director will ensure that the ammunition at the firing site is marked and arranged to meet the firing order of the test.

(7) All personnel will exercise extreme care when handling ammunition components, packaged or unpackaged. In the event damage or possible damage has occurred to live ammunition by accidentally dropping, bumping or other unplanned occurrence, rough treatment, etc., subsequent handling or testing will be suspended until the test director has performed a visual inspection and determined the possible extent of damage. If the test director determines that an unsafe condition exists or could occur from further movement or handling, he will evacuate personnel from the area. If EOD assistance over and above that provided by the EOC qualified/certified personnel on the site is needed, the test director will notify the site manager's representative.

(8) Ammunition should not be unpackaged or packaged in the storage magazine.

c. Range:

(1) An audible and visual warning device will be used at the test site to warn nearby personnel that a round is to be fired.

(2) Personnel will not be permitted to take shelter in bombproofs used for holding ammunition items.

(3) Ear plugs or ear muffs will be worn by all personnel exposed to excessive noise or blast.

(4) The test director and gunner will assure that the weapon has been properly prepared for the test, including thorough cleaning and inspection of bore for obstructions and foreign objects, proper functioning of firing mechanism, including proper protusion of firing pin, etc.

(5) Loaded weapons will not be left unattended. When firing is suspended, the weapon will be unloaded.

(6) Do not perform work or adjustments on a loaded weapon except to:

(a) Check or adjust azimuth or elevation

(b) Attach firing leads.

(c) Perform misfire procedures

When performing the above permissible work, stand to the rear and side to be clear of recoil, blast or case ejection in the event of accidental discharge.

(7) Firing circuits will be complete with system for interrupting, shorting and grounding. The circuit will contain a removable link or a positive means of locking the firing lines to prevent energizing the circuit. The removable link or key will be maintained by the gun crew member loading the weapon until ready to fire. All firing lines will be checked by test director prior to each firing, for operational safety.

(8) Radio frequency energy transmitters (radar, walkie-talkies, etc.) used in direct support of tests employing electrically initiated explosive devices (primers, squibs, etc.) must be separated from the test firing circuit by minimum distances specified in Table 27-2, AMCR 385-100.

(9) All personnel will be placed under adequate protective cover or removed from the danger zone prior to firing.

MISFIRE OR MALFUNCTION

1. Misfire:

The EOD person will:

a. Check circuit continuity at safe end of firing line using approved testing equipment.

b. If circuit is continuous, attempt to fire again, if feasible.

c. If second attempt to fire fails, observe thirty (30) minute waiting period.

d. After the thirty (30) minute period, the person approaching the weapon will have, in his personal possession, the firing key or detachable firing link. He will visually inspect the firing mechanism. If the firing mechanism operated, he will remove the round and correct the defect. If the firing mechanism did not operate, he will set to safe position, check seating of round and attempt to fire again.

e. If round does not fire after above procedure, observe thirty (30) minute waiting period, he will remove round, remove propellant increment and return to assembly area for replacement of the propellant assembly.

2. Malfunction:

WARHEAD

No attempt will be made to save any explosive loaded components from a round that has been fired.

If impacting projectile fuze (HE warhead) has failed to function after being fired, wait thirty (30) minutes. (The test director will notify the site manager's representative if EOD assistance beyond that provided by the on-site certified EOD personnel is required.) At that time, the EOD person will:

(1) If warhead is visible:

(a) Destroy in place without (repeat without) touching, jarring, etc.

(b) If warhead is broken, fragmented, destroy fuze and major section in place. Gather all unburned explosive and destroy in accordance with approved procedures.

(2) If warhead is nonvisible:

(a) Wait thirty (30) minutes.

(b) Gently cover area where warhead is located with a C-4 charge or jet tapper and detonate. Be careful not to disturb round while emplacing charge.

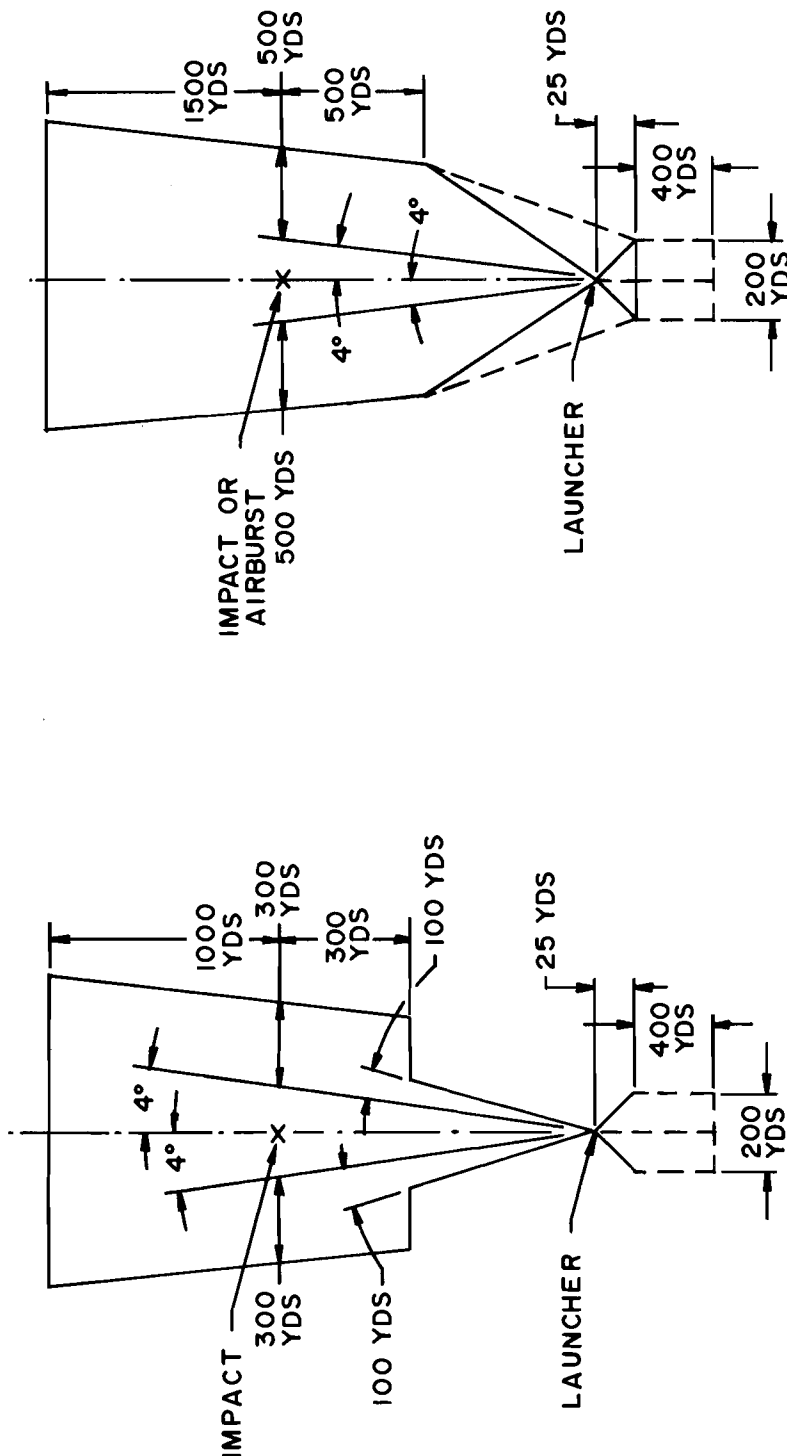
(c) If round is still intact or if test personnel believe it is, wait minimum of thirty (30) minutes then repeat above procedures until round is destroyed.

NOTE: All after-firing procedures are in the control of the qualified EOD personnel. The above is written only for his information and guidance.

DANGER ZONE
OVER 2.36 INCH TO 4.5 INCH ROCKETS

FIRING HIGH EXPLOSIVE AMMUNITION

FIRING INERT & PRACTICE AMMUNITION



SOLID LINE--ONLY FOR ACCEPTANCE TESTS AND TESTS WHEREIN NO DANGEROUS PERFORMANCE OR SEPARATION IS TO BE EXPECTED. BROKEN LINE--ADD FOR EXPERIMENTAL, DEVELOPMENT, TEMPERATURE, AND OTHER TESTS WHEREIN SOME DANGEROUS PERFORMANCE OR SEPARATION IS EXPECTED OR HAS ALREADY OCCURRED.

WHEN THE LAUNCHER IS LOCATED IN A STOCKADE, NO DANGER ZONE TO THE REAR WILL BE OBSERVED.

Safety fan (sample).

TABLE 1B

Danger Zone for Firing Rockets

Up To and Including 2.36"		Over 2.36" to 4.5"		4.5" and Over	
Inert or Practice Ammunition	High Explosive Ammunition	Inert or Practice Ammunition	High Explosive Ammunition	Inert or Practice Ammunition	High Explosive Ammunition
Figure 1 Diagram 5					
A 300	B 800	B 1000	B 1500	B 1500	B 2000
B 500	C 200	C 300	C 500	C 500	C 800
F 15	F 15	D 300	D 500	D 500	D 800
H 100	H 100	F 25	F 25	F 200	F 200
G* 100	G* 100	H 200	H 200	H 600	H 600
	J 2 deg	G* 400	G* 400	G* 600	G* 600
		J 4 deg	J 4 deg	J 4 deg	J 4 deg

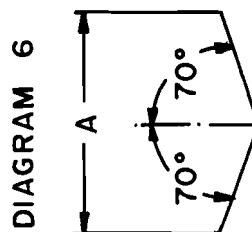
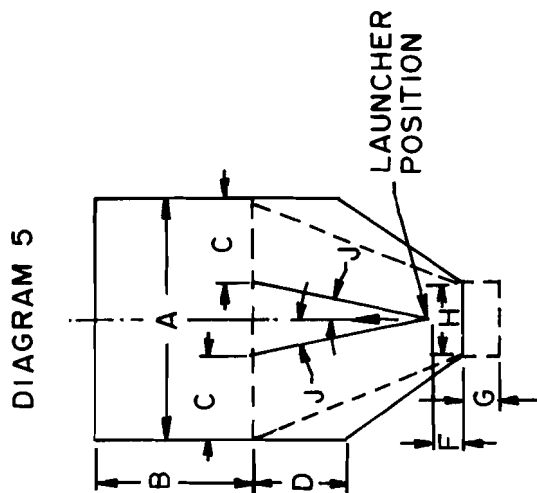
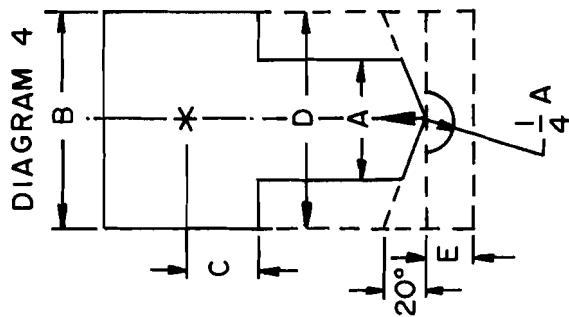
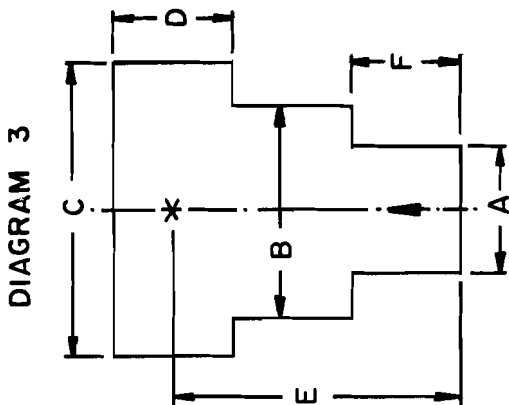
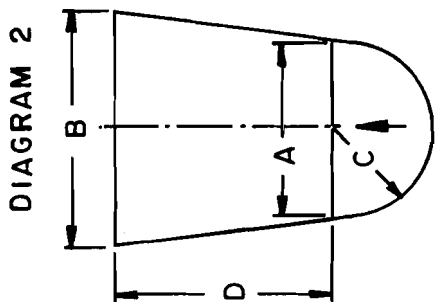
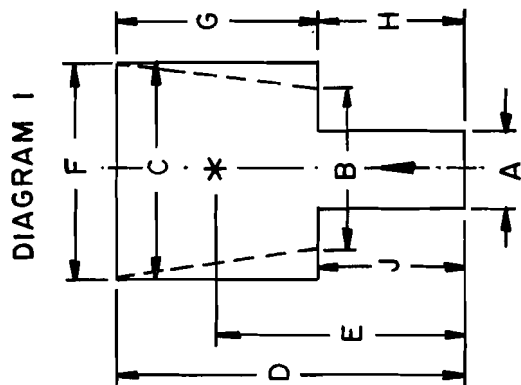
* Add for experimental, development, temperature and other tests within some dangerous performance or separation is expected or has already occurred.

When the launcher is located in a stockade, no danger zone to the rear will be observed.

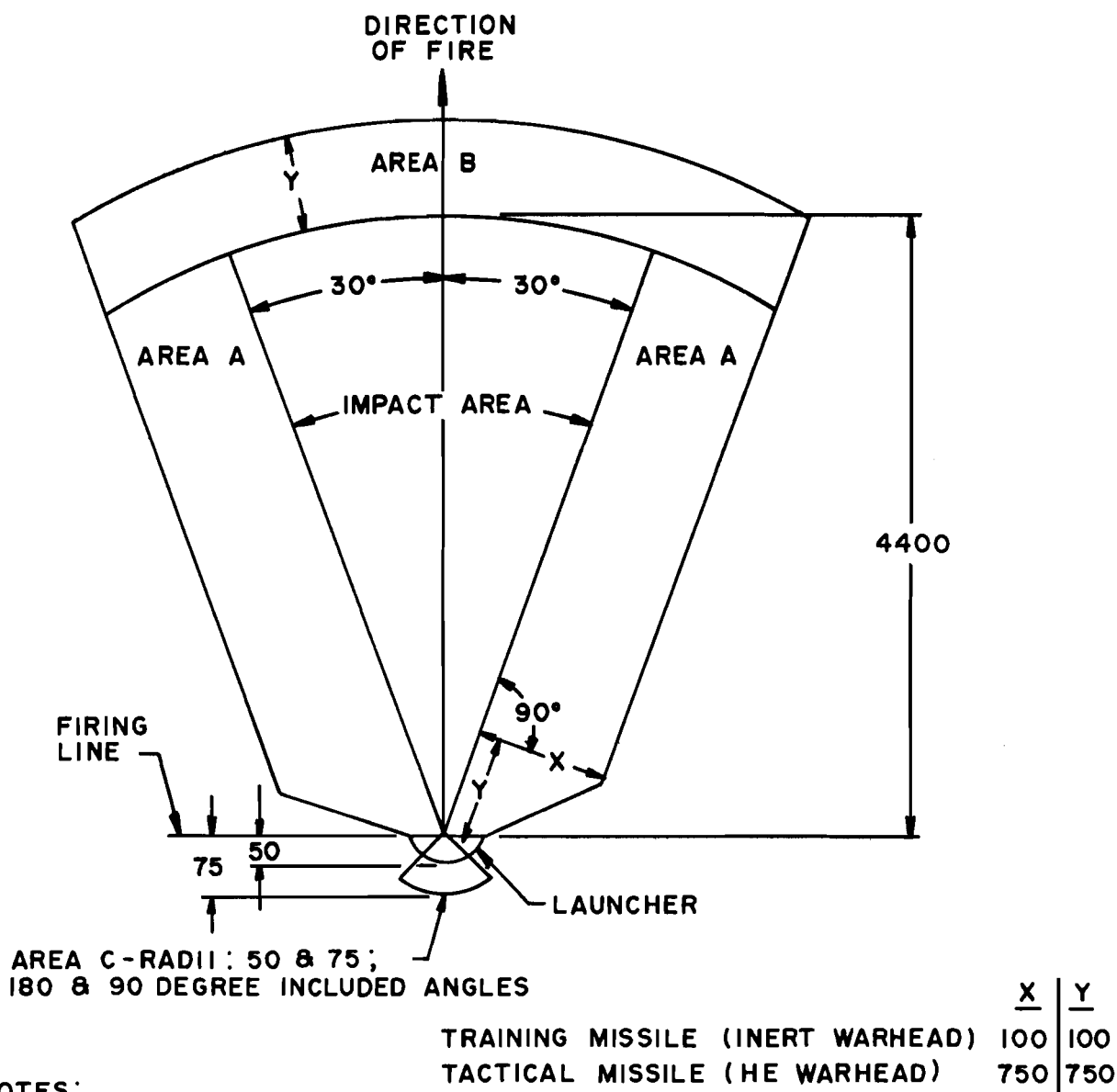
For air-to-ground firing from rotary or fixed wing aircraft, the above danger zones will apply after J has been determined by Range Control.

When firing the 2.75 FFAR and the 115mm rockets at low angle elevations (below 15°), increase Dimension B to 4000 meters.

When firing all experimental rockets, use the maximum range of weapon system for Dimension B.



BASIC DANGER ZONE TYPES



NOTES:

1. NOT TO SCALE
2. ALL DIMENSIONS ARE IN METERS

SURFACE DANGER AREA FOR TERRESTRIAL FIRING
OF THE TOW ATGM AT A FIXED TARGET

TARGET ASSESSMENT

1. The test director will inspect the target structure to insure that the building is safe for entry by the Assessment Team.
2. Assessment Team members will wear hard hats and safety glasses or goggles.
3. In the event of fire, the test director, assisted by two designated personnel, will mask and extinguish the fire from outside the building if possible. If entry is required, the test director and one assistant will enter the room. The third person will stand outside the entryway prepared to assist or extract the firefighting party.

APPENDIX C

LIST OF MATERIAL AND EQUIPMENT
(SAMPLE)

EXAMPLE OF SUPPLIES REQUIRED FOR TEST

250	Sheets	Celotex, white	4' x 8' x 1/2"
150	Sheets	Plywood, construction grade	4' x 8' x 3/8"
50	Boards		2" x 4" x 16'
200	Boards		2" x 4" x 8'
25 lbs		Roofing nails	1-1/4"
25 lbs		Nails	12 penny
8	Cans	Spray Paint - yellow	
8	Cans	Spray Paint - white	
8	Cans	Spray Paint - red	

EQUIPMENT REQUIRED FROM TEST SITE AGENCY

1. Truck (pickup)
2. Trailer (in existing revetment)
3. Radio (installed in trailer)
4. Telephone (installed in trailer)
5. Portable bathroom
6. Generator
7. Fuel for truck and generator

EXAMPLE OF EQUIPMENT NEEDED AT TEST SITE FOR THE EFFECTIVENESS
EVALUATION OF VARIOUS AMMUNITION AGAINST MASONRY STRUCTURES PROGRAM

3 ea hard hats
 2 ro cloth backed tape
 1 ea fire extinguisher
 3 pr asbestos gloves
 4 pr leather gloves
 3 pr safety goggles
 1 ea Distance Tapemetric
 1 ea metric tape
 2 ea hand saws
 4 ea hammers (claw)
 1 ea crescent wrench
 30 ea sand bags
 1 ea tool box - miscellaneous tools
 1 ea Skill saw
 Set #'s and letters
 1 ea tripod, Star-D mfg

 1 ea DRAGON launcher
 1 ea TOW launcher
 1 ea 90mm RR
 1 ea 106mm RR
 1 ea Navy 81mm mortar

	<u>Serial Number</u>
1 ea camera, Redlake Hycam, 16mm	169
1 ea camera, Redlake Hycam, 16mm	170
1 ea camera, Milliken, 16mm	6849-1
1 ea lens 18-108mm, V6x18	18965
1 ea lens, 25mm	24949
1 ea lens, 50mm, Wollensak	857591
1 ea lens, 50mm, Wollensak	857674
1 ea lens, 101mm, Wollensak	853047
1 ea lens, 101mm, Wollensak	853052
1 ea lens, 152mm, Wollensak	961152
1 ea lens, 152mm, Wollensak	962768
1 ea tripod, Saltzman	41A2317
1 ea tripod, Saltzman	41A1068
1 ea meter, VOM Triplet, Model 130	NA
1 ea meter, light, Hycam	44474
1 ea power supply, Kepco 0-30 vdc	70011
1 ea power supply, 0-30 vdc	NA
2 ea timing light units	NA
3 ea control boxes	NA
1 ea sequence timer	NA

(Continued)

EXAMPLE OF EQUIPMENT NEEDED AT TEST SITE FOR THE EFFECTIVENESS
EVALUATION OF VARIOUS AMMUNITION AGAINST MASONRY STRUCTURES PROGRAM
(Continued)

	<u>Serial Number</u>
1 ea firing circuit	NA
1 box assorted tools	NA
1 ea siren, 110 vac, No. 8199	ID No. 56738
1 ea shorting box	NA
1 ea transfer box	NA
11 rl assorted cable	
Camera, Mamiya, Model M645-1000S	L-49257
Lens, Mamiya, 80mm f/2.8	84091
Lens, Mamiya, 45mm f/2.8	25464
Lens, Mamiya, 210mm f/4	33614
Filter, UV, size 67mm	NA
Filter, UV, size 58mm	NA
Filter, UV, size 77mm	NA
Prism Finder, Cds, Mamiya	NA
Film inserts - 3 each	NA
Hand grip, Mamiya	NA
Case, Aluminum, Mamiya	NA
Flash Unit, Vivitar, Model 285	NA

(Concluded)

EXAMPLES OF EXPLOSIVES NEEDED AT TEST SITE FOR

WEAPONS TEST

200 ea Squib, Electric, DuPont S-67

6 ea Charge, Demolition Block - M5A1, 2-1/2 lb. ea

50 ea Cap, Blasting, Electric, Engineers Special, J-2

9 ea Jet Tappers (Perforators) - Shaped Charges -
Model 16-A

3 ea 90mm HEAT rounds

3 ea DRAGON HEAT rounds

5 ea TOW HEAT rounds

2 ea SHAWL HE warheads

2 ea M456 HEAT warheads